Channel Islands National Park Intertidal Monitoring Program Review
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Introduction

The Channel Islands has a high proportion of the Santa Barbara Channel's rocky-intertidal habitat. These areas are relatively pristine but can be impacted by oil spills and human visitation. In addition, changes to long-lived species assemblages may provide information on climate change.

The Channel Islands National Park implemented a biological monitoring program in the late 1980's, with long-term funding through the National Park Service (NPS) Inventory and Monitoring program. Twelve different monitoring protocols were designed to describe communities and populations and track long-term trends in terrestrial and marine systems of the Park. Protocols that have been implemented include vegetation, landbirds, small mammals, herpetofauna, seabirds, rocky intertidal systems, kelp forests, beaches and sandy lagoons, and weather. Between 5 and 15 years of data have been collected across these protocols, and some of them have sufficient information for trend analysis. An important component of the Channel Islands monitoring program is periodic review of the data, to determine whether adjustments in sampling techniques, study design or data handling could make the program better. A group of scientists reviewed the kelp forest program in 1996, and the landbird, vegetation, seabird, and rocky intertidal programs are being reviewed in 2000/2001.

A technical review of the rocky-intertidal monitoring program was held January 17-19, 2001 at Ranch Marino, a UC Natural Reserve in Cambria California. Thirty participants (Table 1) used presentations of the goals of the monitoring program, monitoring protocols, and a power analysis of the data collected thus far as a basis for discussion. The group found that the Park's program was effective at meeting its stated goals. The participants were impressed with the spatial and temporal coverage of the program and the extent to which it was compatible with other ongoing monitoring programs in the area. They provided useful suggestions for improving the program that were well received by the Park Staff. Participants were pleased with the review process, especially since it provided an exchange of information for many groups conducting rocky-intertidal monitoring.

Specific objectives of the review were to:

- Ensure that the monitoring protocol is achieving the Park's objectives for its monitoring program;
- Identify the level of temporal change that can be detected with the existing protocol and the level of confidence in detecting change;
- Identify opportunities and techniques to improve power and efficiency of monitoring;
- Accommodate improvements in technology (such as data collection technology, GPS, database management software), as appropriate, into the protocols; and
- Foster the cross-linking of protocols and integration across monitoring programs to help the Park better understand ecosystem dynamics.

Original program goals

Setting clear, unambiguous scientific and management goals for any monitoring program is a necessary first step in program design. Kate Faulkner presented the management goals as were stated in previous protocol design documents. Program goals were:

1. Monitor trends in population dynamics of selected indicator organisms

2. Determine normal limits of variation of selected indicator organisms

3. Discover abnormal conditions (such as alien species or changes due to oil spills, climate change, harvest, etc.)

4. Identify and communicate issues to park management and collaborators

5. Measure effectiveness of management actions

Protocol

Dan Richards gave a summary of the monitoring program (Richards and Davis 1988). Much of the Discussion revolved around the choice of fixed versus randomized plots. The use of fixed plots, especially those that are not randomly established, makes it difficult to extrapolate findings to the rest of the rocky intertidal because sites are not necessarily representative of the habitat. The value of fixed plots is that they target assemblages that are, apriori, known to be easy to monitor and suspected of being important ecologically. Despite a healthy discussion on the fundamental pros and cons of a fixed plot sampling approach, there was a near consensus that the choice of fixed plots helped the park meet the goal s of the program by that the fixed-plot approach needed to augmented. There was also extended discussion about point contact versus layered sampling data collection. The Park uses point contact, only scoring the top (dominant) species. In other areas, layering of algae is very common and such an approach would not be appropriate. Finally, due to the long-term nature of the data set and unexpected changes in assemblages over time, participants were concerned about what happened when a plot was lost over time or an assemblage changes over time.

Some of the workshop was spent sharing information and updating participants on various rocky-intertidal monitoring activities occurring elsewhere. One example was a demonstration of the use of hand-held computers for taking data in the field. This system is in use by the PISCO group. It involves a hand-held Visor computer with a bar-code scanner attachment. Transect data are entered into the computer in the field so transcription errors are avoided during data entry.

The participants had the following concerns:

1. Fixed plots do not provide information on the composition of the rocky-intertidal community. In many cases, knowledge of this composition is desirable and comprehensive surveys seem warranted.
2. The shorebird protocol is too informal.
3. The species list is subject to errors associated with observer expertise.
4. The motile invertebrate count is sensitive to variation in observer expertise
5. The surfgrass counts were too few to be meaningful.
6. Lumping barnacle taxa is not appropriate.
7. The program needs to deal with assemblages that change location over time.
8. In what cases, besides owl limpets and abalone, is biomass or size structure a possible addition?
9. Voucher specimens are needed.
10. Overview photos are needed.
11. Need to determine if declines in the data represent trends or artifacts of the fixed plot design (e.g., rockweed).
12. Only counting the top layer might not be appropriate for areas with layered taxa.

Power analysis and statistical concerns

Power analysis can provide a decision making tool for what types of sampling could be bolstered, kept as is or eliminated. Minchinton and Raimondi (2001) summarized an extensive power analysis of much of the data. Their report is summarized here. Essentially, the analysis created hypothetical "impacts" to the assemblages and asked if standard statistical methods were able to detect the hypothetical change. Although few comparisons met the assumptions needed to conduct a Before-After-Control-Impact analysis, if an actual impact analysis was necessary, there would be several options (de-trending the data, only using most recent years, etc.) available to meet the assumptions. The authors noted that it is possible that if data sets that did not meet the assumptions were used that the power to detect change would be lower. Other, more sophisticated methods of analysis would be necessary in the event of an impact assessment. For the several analyses that did meet the assumptions, there was a high power to detect change. The high power obtained was at least partially due to small variances due to non-randomly allocated fixed plots that were repeatedly sampled over time. In all but one case, it was possible to detect a 50% change 80% of the time. In most cases, it was possible to detect a 20% change 80% of the time. Comparisons using the *Endocladia* assemblage had the weakest power, most likely due to inherent seasonal variation. There was no indication that more frequent sampling was merited. In addition, because multiple sites only increased power by small amounts, there was little evidence that additional sites should be sampled to increase power. However, the multiple sites spread across the island provides tremendous flexibility for analysis. In addition, existing multiple sites and twice-yearly sampling provide a great opportunity for detecting an impact that may be patchy in space and time. There was evidence that negative trends in the data were over represented because high-density quadrats were initially selected. This was particularly a problem for long-lived species. A more meaningful BACI analysis is possible if early years are ignored.

Changes to the protocol

The Park Monitoring Staff agreed to:

Conduct 3 year comprehensive surveys to detect distribution shifts and estimates proportions of each habitat type in order to address concerns about fixed plots not being representational.

Alter photoplot scoring for better taxonomic representation

a) Split barnacle plots into strictly *Balanus*/*Cathamalus* or *Tetraclita* zones.

b) Split rockweed plots into strictly *Hesperophycus* or *Pelvetia* zones where clear zonation occurs.

Map photoplots in the field to ensure consistent scoring in the lab.

To improve the quantification of the Abalone/Seastars/Shorebirds/Species List:

a) Delineate the site

b) Use irregular plots incorporating suitable habitat to create quantifiable areas.

c) Set upper and lower limits of search areas.

To improve *Lottia* monitoring:

a) Increase number of plots per site to 5 were suitable habitat is available.

b) Implement 1meter plots at sites were abalone plots are currently used to obtain densities.

c) Use supplemental sampling for size frequencies when an adequate number of individuals were not obtained within plots.

d) Continue to exclude individuals under 15mm from database.

To better prioritize time in the field:

a) Make the species list a lower priority.

b) Obtain the species list during the comprehensive surveys (every 3 years).

To improve the value of the Motile/Mobile Invertebrates counts

a) Continue to sample within current photoplots and begin subsampling, model subsumable effort after mainland sampling (i.e. break into 8ths) and target a specific number of individuals.

b) Review the sampling method collaboratively after 1-3 sampling periods to refine methodology.

c) Exclude size measurements until revisions of the methodology can be more completely analyzed and reviewed

d) Initiate some method to enumerate shore crabs.

Changes to the protocol (continued)

To improve utility of Physical Measures

a) Work with Jack Engle to standardize a datasheet.
b) Use ibutton technology to refine temperature data .
c) Begin to access swell data and adjust for individual site position

To improve collaboration, work with MARINE to:

a) Promote taxonomy workshops
b) Advocate taxonomic support for museums

A revised rocky-intertidal monitoring protocol handbook with a sample design that incorporates recommendations from this review will be written to include the chances to the protocol.

References

Minchin, T. and P. Raimondi, 2001. Long-term Monitoring of Rocky Intertidal Communities at the Channel Islands National Park: Descriptive Summary of Spatial and Temporal Trends and Statistical Evaluation of Monitoring Protocol . Internal Report for the Workshop.

Richards, D. V. and G. E. Davis. 1988. Rocky Intertidal Communities Monitoring Handbook. National Park Service. Channel Islands National Park. Ventura. NTIS. 15pp.

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